



September 19, 2003

Document Control Desk  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555

Attention: Ms. K. R. Cotton

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS)  
DOCKET NO. 50/395  
OPERATING LICENSE NO. NPF-12  
RESPONSE TO NRC BULLETIN 2003-02, LEAKAGE FROM  
REACTOR PRESSURE VESSEL LOWER HEAD PENETRATIONS  
AND REACTOR COOLANT PRESSURE BOUNDARY INTEGRITY

The U. S. Nuclear Regulatory Commission (NRC) issued NRC Bulletin 2003-02 to (1) require that pressurized water reactor (PWR) utilities provide a description of the Reactor Pressure Vessel (RPV) lower head penetration inspection program that has been implemented, (2) a description of the RPV lower head penetration inspection program that will be implemented during the next and subsequent refueling outages, (3) if unable to perform a bare-metal visual inspection of each penetration during the next refueling outage, plans to perform a bare-metal visual inspection during subsequent refueling outages including plans for any penetration inspection to be performed during the next refueling outage, and (4) if no plans to perform either a bare-metal visual or non-visual examination of the RPV lower head penetrations at the next or subsequent refueling outages, the basis for concluding that the inspections performed will assure applicable regulatory requirements related to the structural integrity of the reactor coolant pressure boundary are and will continue to be met. Additionally, Bulletin 2003-02 requires that all addressees provide to the NRC a written response in accordance with the provisions of 10 CFR 50.54(f).

All licensees that will enter refueling outages before December 31, 2003, have been requested to provide a response to the NRC Bulletin within 30 days of the issuance date of the bulletin. South Carolina Electric & Gas Company (SCE&G) has a refueling outage scheduled to begin October 11, 2003.

SCE&G acting for itself and as agent for South Carolina Public Service Authority, hereby submits the attached in response to NRC Bulletin 2003-02.

A109

Document Control Desk  
IEB 2003-002  
O-C-03-2647  
RC-03-0200  
Page 2 of 2

Should you have questions, please call Mr. Ron Clary at (803) 345-4757.

I certify under penalty of perjury that the information contained herein is true and correct.

9/19/03

Executed on



Stephen A. Byrne  
Senior Vice President, Nuclear Operations

PAR/SAB/dr  
Attachment

c: N. O. Lorick  
N. S. Carns  
T. G. Eppink (w/o Attachment)  
R. J. White  
L. A. Reyes  
K. R. Cotton  
K. M. Sutton  
T. A. McAlister  
F. A. Miller  
G. G. Williams  
NRC Resident Inspector  
NSRC  
RTS (C-03-2647)  
File (815.02)  
DMS (RC-03-0200)

## **NRC Bulletin 2003-02 Response**

This response addresses the requested information in NRC Bulletin 2003-02 and discusses: 1) the current Reactor Pressure Vessel (RPV) lower head penetration inspection program, 2) the RPV lower head penetration inspection program that will be implemented at the plant during the next and subsequent refueling outages. Requested information (c) and (d) on page 7 of the Bulletin are specific to plants that either cannot perform a bare metal inspection of their RPV lower head penetrations or have no plans to perform this inspection, and as such do not apply to V. C. Summer Nuclear Station (VCSNS).

### **1(a) CURRENT RPV LOWER HEAD PENETRATION INSPECTION PROGRAM**

As identified in the response to Question 5 (Reference 1) of the NRC request for additional information on boric acid inspection programs, previous inspections of the RPV lower head penetrations at V. C. Summer Nuclear Station (VCSNS) have been performed as part of the ASME Section XI system leakage test walkdown performed at every (18 month) refueling outage with the system at normal operating pressure and the insulation in place. These walkdown inspections are performed by procedure and documented on a system pressure test report in accordance with our ASME Section XI program and in accordance with our boric acid inspection program. The system pressure tests have not identified any RPV lower head penetration leakage to date.

During refueling outage 12, a through-wall crack in A hot leg allowed some boric acid to flow down the side of the insulation surrounding the RPV. The mirror insulation shingled design prevented primary water (flowing downward) from getting underneath to the surface of the reactor vessel.

### **1(b) PLANNED RPV LOWER HEAD PENETRATION INSPECTION PROGRAM**

#### **Extent of the inspections**

During refueling outage (RFO) 14, scheduled to begin October 11, 2003, SCE&G has prepared to perform a visual inspection utilizing state of the art remote inspection equipment and techniques to obtain the best possible coverage of the penetrations. The intent is to perform a remote visual bare-metal inspection of each penetration in the lower head of the RPV. This inspection should produce a record that shows 360 degrees circumferentially around each penetration. Any deposit of boric acid should be easily identified. This bare-metal examination is a first of a kind examination at VCSNS in a high dose area, and will be

performed to the maximum extent possible. Any limitations will be documented and appropriate resolution obtained prior to RFO 15. Areas that were not fully inspected during RFO 14 will be inspected in RFO 15.

The subsequent refueling outage is scheduled for Spring, 2005 and will require a 100 percent bare-metal visual inspection of the circumference around the penetration tubes, which may not have been inspected during RFO 14. Modifications to the insulation may have to be performed, however it is expected that future RPV lower head instrumentation penetration examinations will be conducted utilizing a remote camera with the majority of the RPV insulation in place. The scope of subsequent inspections will be dependent on industry guidance.

The lower head on the RPV is covered with metallic insulation secured with straps and buckles that have not been removed since construction. Due to the configuration of this insulation and expected dose rate in the area under the lower head, several pieces of insulation will be removed and a robotic inspection tool inserted. Plant drawings indicate sufficient clearances to permit obtaining a 100 percent circumferential visual inspection of the lower RPV instrumentation penetrations. During this examination, as a contingency, detailed walkdowns will be conducted in order to prepare for an insulation design change or modification at the next refueling outage that will ensure a complete examination. Visual detection of boric acid whether on the RPV or on the insulation facing the RPV will be considered as a non-conforming condition.

Additionally, the inspections performed for Boric Acid leakage (Generic Letter (GL) 88-05 and ASME Code requirements) will continue to be performed without additional modification to the program unless examination results demonstrate that a visual inspection while at pressure and temperature is ineffective. SCE&G has recently made significant changes to the inspection program for RFO 14. These walkdown inspections have been successful in satisfying the requirements of GL 88-05 and the ASME Code required inspections and along with the bare-metal visual inspections will continue to be utilized to demonstrate compliance with these requirements.

#### **Qualification standards for the inspection methods**

SCE&G has contracted with a vendor to provide the equipment to perform our bare-metal inspection of the lower head instrumentation penetrations. This inspection shall be consistent with those performed at other nuclear power plants. The robotic camera will have a minimum of 380,000 pixels resolution and is commensurate with the equipment utilized for the bare metal inspection performed on the RPV upper head penetrations last refueling outage. SCE&G personnel certified to a minimum of Level II, visual examination (VT-2) and who

have received specific training on inspection for Boric Acid contamination will be responsible for performance of the examination and evaluation of the results.

**Process used to resolve the source of findings of boric acid or corrosion**  
SCE&G will utilize the Condition Evaluation Report and nonconformance control process to document and evaluate all findings of leakage during the bare-metal RPV lower head instrumentation penetration inspection. The process will include evaluations to determine if the findings are relevant or non-relevant as an RCS leak as well as the source of the leakage. The findings will include indications of leakage whether on the RPV vessel or on the metallic insulation.

Unlike the reactor vessel head upper penetrations, the bottom head location has no potential leak source location during normal plant operation that could result in boron accumulation. Cavity seal ring leakage that occurs during a refueling outage only occurs at low temperature and results in staining without "popcorn like" accumulation features of an RCS leak at normal operating temperature. The lower head location of the instrumentation penetrations is also not likely to be affected by settled debris that could mask a VT-2 examination. Tools to evaluate relevant indications of leakage (boron accumulation) would include sample collection for chemical and isotopic analysis.

Examples of non-relevant leakage may include thin films or stains of boron or light surface rust having a characteristic of no discernable thickness with no accumulation around the penetration. Non-relevant indications would typically have a trail leading to the source, which is away from the RPV lower head penetration. Each case of leakage will be documented using the condition report process identifying the determination of if the finding is relevant or non-relevant to leakage from a RPV lower head penetration nozzle. Thin film boron stains or light rust films are not likely to be chemically or isotopically analyzed due to there being no accumulation of a sample.

#### **Documentation of the inspection**

Documentation of the examination will consist of a report signed by the qualified VT-2 examiner that performed the examination. Video and photographic images that support the examination findings will supplement the report. The report and supporting images will be plant records and protected as such.

**Basis for conclusion that applicable regulatory requirements are satisfied.**  
VCSNS has reviewed its response to Generic Letter (GL) 88-05, Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants, NUREG/CR5576, Survey of Boric Acid Corrosion of Carbon Steel

Components in Nuclear Plants, and the boric acid inspection program elements. Based on the information provided in this response, VCSNS concludes that there is reasonable assurance that the station is in compliance with applicable regulatory requirements and our current licensing basis.

Additionally, VCSNS TS 3.4.6.2 requires that there is zero pressure boundary leakage. The visual examination to be performed will demonstrate that this requirement remains satisfied. Small amounts of leakage can be detected visually and it has been shown that timely detection by visual examination will ensure the structural integrity of the RPV head penetrations with respect to circumferential cracking.

Industry studies have concluded that visual inspections of the Reactor Coolant System pressure boundary have been proven to be an effective method for identifying leakage from primary water stress corrosion cracking (PWSCC) cracks in Alloy 600 base metal and Alloy 82/182 weld metal. (Reference 2)

Historically, (prior to South Texas) there has not been any leakage from RPV lower head instrumentation penetrations. Although a unique cause for the South Texas Project indications has not been identified, significant industry operating experience coupled with the visual examination will provide a high confidence that this regulatory requirement remains satisfied.

**1(c) Plans for subsequent outages if unable to perform a bare-metal inspection of the RPV lower head instrumentation penetrations and description of plans for the up-coming refueling outage.**

As stated in 1(b) above, SCE&G will conduct a best effort bare-metal inspection of the RPV lower head instrumentation penetrations this up-coming outage. SCE&G will also perform a walkdown of the insulation on the lower RPV head to verify configuration in case modifications or changes are deemed necessary in order to obtain a 100 percent bare-metal inspection of the lower head instrumentation penetrations.

**1(d) If not planning to perform either a bare-metal visual inspection or a non-visual examination of the RPV lower head instrumentation penetrations at the next refueling outage or subsequent outages, the basis for concluding that inspections performed will assure applicable regulatory requirements related to the structural integrity of the reactor coolant pressure boundary are and will continue to be met.**

As stated in 1(b) above, SCE&G is planning to perform a best effort bare-metal visual inspection of the VCSNS RPV lower head instrumentation penetrations during RF-14, (next refueling outage). The results of the examination will demonstrate continued compliance with the applicable regulatory requirements.

**2 Within 60 days of plant restart following the next inspection of the RPV lower head penetrations, a summary of the inspections performed, the extent of the inspections, the methods used, a description of the as-found condition of the lower head, any findings of relevant indications of through-wall leakage, and a summary of the disposition of any findings of boric acid deposits and any corrective actions taken as a result of indications found.**

SCE&G shall submit the requested information within 60 days following the restart of VCSNS following refueling outage 14.

References:

1. SCE&G letter to NRC (Document Control Desk), RC-03-0016, January 24, 2003, "Request for Additional Information Regarding 60 Day Response to NRC Bulletin 2002-01 Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity"
2. EPRI TR-103696, "PWSCC of Alloy 600 Materials in PWR Primary System Penetrations," July 1994
3. "Visual Examination for Leakage of PWR Reactor Head Penetrations on Top of RPV Head: Revision 1 of 1006296, Includes Fall 2002 Results," EPRI, Palo Alto, CA: March 2002, 1006899